Warm Up # 2- 4

Use: $y - f(c) = m(x - c)$

For a line tangent to f(x) at (c, f(c)), $m = \lim_{x \to c} \frac{f(x) - f(c)}{x - c}$

1. Find the line tangent to $y = x^2 - 4$ at $x = 3$.

2. Find the line tangent to $y = x^3 + 2x^2 - 5x + 1$ at $x = -1$

No Warm Up tomorrow.

Staple and turn in:

<u>Week 2 Classwork</u>

Warm Up on top

Tan Limits WS

HW Questions: p. 92

In Exercises 1–20, find the given limit (if it exists).

1. $\lim_{x\to 2}(5x-3)$ 3. $\lim_{x\to 2}(5x-3)(3x+5)$ 5. $\lim_{t\to 3}\frac{t^2+1}{t}$

7. $\lim_{t\to -2}\frac{t+2}{t^2-4}$ 9. $\lim_{x\to 0}\frac{[1/(x+1)]-1}{x}$ 11. $\lim_{x\to -1}\frac{x^3+1}{x+1}$ factor

13. $\lim_{x\to 0^+}\left(x-\frac{1}{x^3}\right)$ 15. $\lim_{x\to -2}\frac{2x^2+x+1}{x+2}$ 17. $\lim_{x\to -1}\frac{x+1}{x^3+1}$ factor

graph it or look at table

$\frac{1\cancel{(x+1)}}{\cancel{(x+1)}(x^2-x+1)}$

19. $\lim_{x\to 1}\frac{x^2-2x+1}{x+1}$

9. $\lim_{x\to 0}\frac{[1/(x+1)]-1}{x}$

$\frac{1}{x}\left[\frac{1}{x+1}-1\left(\frac{x+1}{x+1}\right)\right]$

$\frac{1}{x}\left(\frac{1-x-1}{x+1}\right)$

$=\lim_{x\to 0}\frac{1}{x}\left(\frac{1-x-1}{x+1}\right)$

$=\lim_{x\to 0}\frac{1}{\cancel{x}}\cdot\frac{-\cancel{x}}{x+1}$

$=\lim_{x\to 0}\frac{-1}{x+1}$

$=-\frac{1}{1}$

$=\boxed{-1}$

13. $\lim_{x\to 0^+}\left(x-\frac{1}{x^3}\right)$

$0^+ - \frac{1}{0^+}$

sm pos #

$0^+ - \infty$

$-\infty$

21. Estimate the limit

$$\lim_{x \to 1^+} \frac{\sqrt{2x+1} - \sqrt{3}}{x - 1}$$

by completing the following table.

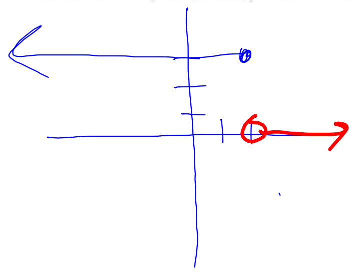
x	1.1	1.01	1.001	1.0001
$f(x)$				

23. Evaluate the limit in Exercise 21 by rationalizing the numerator.

In Exercises 25–30, determine whether the given limit statement is true or false.

25. $\lim_{x \to 0} \frac{|x|}{x} = 1$

27. $\lim_{x \to 2} f(x) = 3$, where $f(x) = \begin{cases} 3, & x \leq 2 \\ 0, & x > 2 \end{cases}$



29. $\lim_{x \to 0^+} \sqrt{x} = 0$

In Exercises 31–38, determine the intervals on which the given function is continuous.

31. $f(x) = [\![x + 3]\!]$

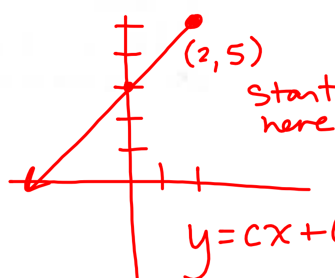
33. $f(x) = \begin{cases} \frac{3x^2 - x - 2}{x - 1}, & x \neq 1 \\ 0, & x = 1 \end{cases}$

35. $f(x) = \frac{1}{(x-2)^2}$

37. $f(x) = \frac{3}{x+1}$

39. Determine the value of c so that the following function is continuous on the entire real line.

$$f(x) = \begin{cases} x + 3, & x \leq 2 \\ cx + 6, & x > 2 \end{cases}$$

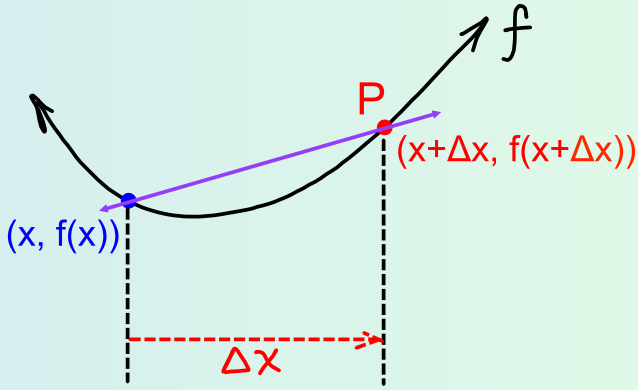


$y = cx + 6$

$5 = c(2) + 6$

$c = -\frac{1}{2}$

The Limit Definition of the Derivative.



$$f'(x) = \lim_{\Delta x \to 0} \frac{f(x+\Delta x) - f(x)}{\Delta x}$$

Provided the limit exists.

We also already know the Alternate Form of the Derivative:

$$f'(c) = \lim_{x \to c} \frac{f(x) - f(c)}{x - c}$$

We have been using it to find the derivative at a known value x = c.

(Finding the slope of a tangent at x = c)

Use the Alternate Form of the Derivative:

Find the slope of the tangent line to the graph of $f(x) = x^2 + 1$ at the point (0, 1)

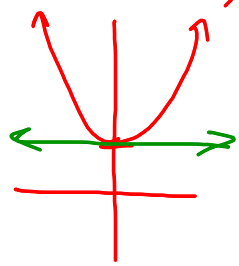
$$f'(c) = \lim_{x \to c} \frac{f(x) - f(c)}{x - c}$$

Find the slope of the tangent line to the graph of $f(x) = x^2 + 1$ at the point (0, 1)

@ (0,1) → $\lim_{x \to 0} \frac{x^2 + 1 - 1}{x - 0}$

$\lim_{x \to 0} x = 0$

interesting



Where the derivative is zero, you have a horizontal tangent.

If $f'(c) = \lim_{x \to c} \dfrac{f(x) - f(c)}{x - c} = \pm\infty$,

then it is a vertical tangent line!

The limit DNE, so f is not differentiable there.

If f is differentiable at $x = c$, then f is continuous at $x = c$

Use the Limit Definition:

$$f'(x) = \lim_{\Delta x \to 0} \frac{f(x + \Delta x) - f(x)}{\Delta x}$$

Find $f'(x)$ for $f(x) = \sqrt{x}$, and use the result to find the slope of f at (1, 1), (4, 2) and (0, 0)

Find $f'(x)$ for $f(x)=\sqrt{x}$, and use the result to find the slope of f at (1, 1), (4, 2) and (0, 0)

$$f'(x) = \lim_{\Delta x \to 0} \frac{\sqrt{x+\Delta x} - \sqrt{x}}{\Delta x} \cdot \frac{\sqrt{x+\Delta x} + \sqrt{x}}{\sqrt{x+\Delta x} + \sqrt{x}}$$

$$= \lim_{\Delta x \to 0} \frac{x + \Delta x - x}{\Delta x(\sqrt{x+\Delta x} + \sqrt{x})}$$

$$= \lim_{\Delta x \to 0} \frac{1}{\sqrt{x+\Delta x} + \sqrt{x}}$$

$$= \frac{1}{\sqrt{x+0} + \sqrt{x}}$$

$$= \frac{1}{2\sqrt{x}} \leftarrow \text{slope} \quad :)$$

@ (1,1) $m = \frac{1}{2(1)} = \frac{1}{2}$

@ (4,2) $m = \frac{1}{2\sqrt{4}} = \frac{1}{4}$

@ (0,0) $m = \frac{1}{2\sqrt{0}}$

$= \frac{1}{0} \nearrow \infty$

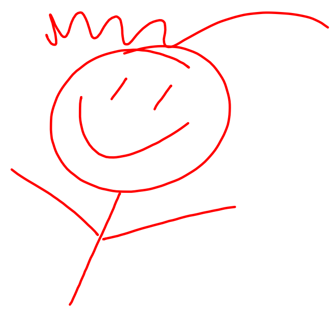
So vertical tangent @ (0,0) slope is undefined.

Review for Ch. 2 Test:

- Strategies for finding limits
- One sided limits
- Equations for lines tangent to a curve
- Continuity
- The Intermediate Value Theorem
- Infinite Limits
- Vertical Asymptotes

(There will be a calculator part and a non-calculator part.)

Review Activity: Match 2 cards together based on the blue graph.



HW:

Review for Ch. 2

Test tomorrow!

Friday's assignment:
p.103 #7-25 odd
and #43